ANTHROPOGENIC AND CLIMATE IMPACTS RECORDED IN RECENT SEDIMENTS FROM LAKE JUNIN, PERU

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Recent human and climatic impacts on lakes can be determined by geochemical analysis of sediment-water interface cores. With a 54 cm short core, we studied trace metal pollution and reconstructed changes in lake hydrology over the past few thousands years in Lake Junin (11°S, 4100m). Mining of copper, lead and zinc has taken place at Cerro de Pasco since 1920 A.D. Lake Junin is located only 30 km downstream from Cerro de Pasco, and the lake sediments show clear evidence of the mining activity. To determine the history of trace-metal deposition and pollution, copper, lead and zinc were extracted from the lake sediments. In the top 12 cm of the record these trace metals increase substantially above background levels (Fig. 1). Copper and lead concentrations increase from 0.013 mg/g and 0.011 mg/g, respectively, to 0.750 mg/g and 0.680 mg/g. Zinc concentrations fluctuate between 1.58 mg/g and 55.80 mg/g. The results for copper and lead are comparable with previous work (e.g. Ministerio de Energia y Minas, Perú 1997), which evaluated the water quality of Lake Junin.

Stable isotope analyses ($\delta^{18}O$ and $\delta^{13}C$) were performed on ostracod carapaces (*Cypridopsis sp.)*. Oxygen isotope values show a 2 ‰ depletion over the last 4000 years (Fig. 1). This trend is comparable with previous work on long cores from Lake Junin (e.g. Metivier, 2000, Seltzer et al, 2000), and suggests increasing humidity over the last 4,000 years. Carbon isotope values show a 2 ‰ enrichment (Fig. 1) and may indicate an increase in primary productivity over the Late Holocene.

The results of this study show human impact, through mining activity, on Lake Junin. Levels of copper, lead, and zinc in the sediments are well above the EPA standards established for metals in the aquatic environment. The input of these metals poses a serious problem to water quality and living organisms. Changes in redox, pH and the addition of organic or inorganic complexes may release the trace metals into the lake and cause serious environmental problems. This study also shows changes in water budget of Lake Junin over the late Holocene. Oxygen isotope depletion is most likely the result of increased moisture over the last 4,000 years. The primary control on carbon isotope values is associated with changes in primary productivity.

References:

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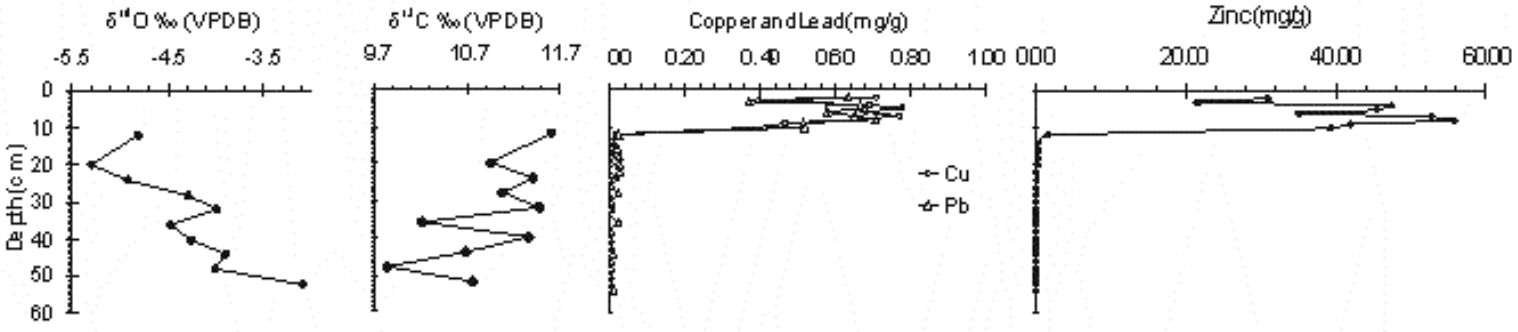

Figure 1. Short-core stratigraphy from Lake Junin, Peru. The stable isotopic analyses were performed on the ostracod *Cyprideopsis*. The trace metal data are from extractions of bulk sediment.